

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A method of incorporating a mark of origin or fingerprint in a CVD single crystal diamond material, which ~~includes~~ comprises providing a diamond substrate, providing a source gas, dissociating the source gas thereby allowing homoepitaxial diamond growth, and introducing in a controlled manner one or more chemical dopants into the synthesis process in order to produce the mark of origin or fingerprint, in the form of defect centres that emit radiation of a characteristic wavelength when excited, in the synthetic diamond material, wherein the concentration of the one or more chemical dopants is such that the mark of origin or fingerprint is not readily detectable under normal viewing conditions, [[or]] does not affect the perceived quality of the diamond material under normal viewing conditions, and does not significantly affect any application properties of the diamond material, but which mark of origin or fingerprint is detectable or rendered detectable by visual detection or using optical instrumentation when exposed to illuminating light of a wavelength that has insufficient energy to excite electrons right across the band gap in diamond, that is capable of exciting the defect centres and is shorter than the characteristic wavelength of the emitted radiation.

Claim 2 (Canceled).

Claim 3 (Previously Presented): A method according to claim 1, wherein the mark of origin or fingerprint is provided in the form of one or more layers or regions grown into the diamond material during synthesis.

Claim 4 (Previously Presented): A method according to claim 1, wherein the one or more chemical dopants introduced into the synthesis process are added in a gaseous form.

Claim 5 (Previously Presented): A method according to claim 1, wherein the chemical dopant, or one of the dopants, provides a source of nitrogen that is incorporated into the diamond, and that produces a mark of origin or fingerprint that shows 575 nm and/or 637 nm luminescence peaks, with their associated vibronic systems, under suitable shorter wavelength excitation.

Claim 6 (Currently Amended): A method according to claim 5, wherein the mark of origin or fingerprint also shows a photoluminescence line at 533 nm.

Claim 7 (Previously Presented): A method according to claim 1, wherein the dopant or dopants provide(s) a source of boron and a source of nitrogen, which elements are incorporated into one or more specific regions of the diamond and which produce a mark of origin or fingerprint that generates characteristic phosphorescence, peaking generally in the range of 400 nm to 500 nm, under suitable shorter wavelength excitation.

Claim 8 (Original): A method according to claim 7, wherein the boron is incorporated into the synthesized diamond material in a concentration less than 0.1 ppm.

Claim 9 (Previously Presented): A method according to claim 7, wherein the boron is incorporated into the synthesized diamond material in a concentration greater than 0.0001 ppm.

Claim 10 (Previously Presented): A method according to claim 7, wherein the concentrations of boron and nitrogen incorporated into the synthesized diamond material lie within a factor of 10 of one another.

Claim 11 (Previously Presented): A method according to claim 7, wherein the boron is present in the synthesized diamond material in a higher concentration than the nitrogen.

Claim 12 (Previously Presented): A method according to claim 1, wherein a combination of layers or regions that generate 575/637 nm luminescence and 400 nm to 500 nm phosphorescence under suitable optical wavelength excitation is grown into the diamond material during synthesis.

Claim 13 (Previously Presented): A method according to claim 1, wherein a layer or region with a center that emits 737 nm radiation under optical excitation is grown into the diamond material during synthesis.

Claim 14 (Original): A method according to claim 13, wherein the one or more dopants include a source of silicon.

Claim 15 (Original): A method according to claim 14, wherein the silicon is incorporated into the synthesized diamond material in a concentration less than 10 ppm.

Claim 16 (Previously Presented): A method according to claim 14, wherein the silicon is incorporated into the synthesized diamond material in a concentration greater than 0.0001 ppm.

Claim 17 (Currently Amended): A method according to claim 1, wherein the ~~detection of the~~ mark of origin or fingerprint is detectable by the human eye, in combination with other suitable optical elements including filters and lenses.

Claim 18 (Currently Amended): A method according to claim 1, wherein the ~~detection of the~~ radiation is detectable by an instrument providing a measure of the intensity of the radiation, or providing an indication whether this value lies above or below a threshold.

Claim 19 (Currently Amended): A method according to claim 18, wherein the detectable radiation ~~being detected~~ is [[the]] 737 nm radiation.

Claim 20 (Currently Amended): A method according to claim 1, wherein ~~detection of~~ the mark of origin or fingerprint is detectable by optical image capture or electronic image capture, in combination with other suitable optical elements including filters and lenses.

Claim 21 (Previously Presented): A method according to claim 1, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres having optical properties that are not observed in natural diamond.

Claim 22 (Previously Presented): A method according to claim 1, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres, the measurable or observable distribution of the defect centres being in a form not observed in natural diamond.

Claim 23 (Previously Presented): A method according to claim 1, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres having optical properties, the combination of the optical properties and the measurable or observable distribution of the optical centres being in a form not observed in natural diamond.

Claim 24 (Previously Presented): A method according to claim 1, wherein the fingerprint or mark of origin provides a means by which modification to the diamond can be identified.

Claim 25 (Original): A method according to claim 24, wherein the fingerprint or mark of origin provides a means by which modification to the diamond by means of annealing can be identified.

Claim 26 (Currently Amended): A method according to claim 1, wherein the fingerprint or mark of origin is ~~used to identify~~ capable of identifying the synthetic nature of the material.

Claim 27 (Currently Amended): A method according to claim 1, wherein the fingerprint or mark of origin is ~~used to identify the~~ capable of identifying a manufacturer, or ~~[[as]] of being a manufacturers~~ manufacturer's process identification mark.

Claim 28 (Currently Amended): A method according to claim 1, wherein the fingerprint or mark of origin is ~~used as or in the manner of~~ capable of acting as a trademark.

Claim 29 (Previously Presented): A method according to claim 1, wherein the substrate is a diamond substrate having a surface on which growth takes place.

Claim 30 (Currently Amended): CVD single crystal diamond material bearing a mark of origin or fingerprint in the bulk thereof, which mark of origin or fingerprint is formed from defect centres that emit radiation of a characteristic wavelength when excited, the concentration of defect centres being such that the mark of origin or fingerprint is not readily detectable under normal viewing conditions, [[or]] does not affect the perceived quality of the diamond material under normal viewing conditions, and does not significantly affect any application properties of the diamond material, but which mark of origin or fingerprint is detectable or rendered detectable by visual detection or using optical instrumentation when exposed to illuminating light of a wavelength that has insufficient energy to excite electrons right across the band gap in diamond, that is capable of exciting the defect centres and is shorter than the characteristic wavelength of the emitted radiation.

Claim 31 (Original): CVD single crystal diamond material according to claim 30, which is prepared, or suitable for preparation, as a gemstone.

Claim 32 (Original): CVD single crystal diamond material according to claim 30, which is prepared as a gemstone, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres having properties that are not observed in natural diamond.

Claim 33 (Original): CVD single crystal diamond material according to claim 30, which is prepared as a gemstone, wherein the mark of origin or fingerprint in the diamond

material is formed by defect centres, the measurable or observable distribution of the defect centres being in a form not observed in natural diamond.

Claim 34 (Original): CVD single crystal diamond material according to claim 30, which is prepared as a gemstone, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres having optical properties, the combination of the optical properties and the measurable or observable distribution of the defect centres being in a form not observed in natural diamond.

Claim 35 (Original): CVD single crystal diamond material according to claim 30, which is prepared as a gemstone, wherein the mark of origin or fingerprint in the diamond material is formed by defect centres, the distribution of the defect centres being observable as a feature through the table of the gemstone.

Claim 36 (Currently Amended): CVD single crystal diamond material according to claim 35, wherein the feature ~~observed~~ observable in the table of the gemstone is a solid geometrical shape or an unfilled geometrical shape, the precise geometry of the geometrical shape reflecting the symmetry of the gemstone about an axis passing at 90° through the table of the gemstone.

Claim 37 (Previously Presented): CVD single crystal diamond material according to claim 35, wherein the gemstone is of a generally round form and the feature observable in the table of the stone is a spot or a ring.

Claim 38 (Original): CVD single crystal diamond material according to claim 37, wherein the gemstone is of a round brilliant form.

Claim 39 (Previously Presented): CVD single crystal diamond material according to claim 35, wherein the gemstone is of a rectangular form and the feature observable in the table of the stone is a solid square or a square outline.

Claim 40 (Original): CVD single crystal diamond material according to claim 35, wherein the feature observable in the table of the gemstone is formed by one or more layers below the girdle of the gemstone lying in a plane approximately parallel with the table of the gemstone.

Claim 41 (Currently Amended): An article comprising the CVD single crystal diamond material according to claim 30, wherein the single crystal diamond material is ~~prepared for an industrial application in which it is~~ a visible element to the user, or is re-useable or needs periodic reprocessing.

Claim 42 (Currently Amended): The article ~~CVD single crystal diamond material~~ according to claim 41, wherein the single crystal diamond material is a cutting blade or a component thereof.

Claim 43 (Currently Amended): The article ~~CVD single crystal diamond material~~ according to claim 42, wherein the single crystal diamond material is a diamond scalpel blade.



Claim 44 (Previously Presented): CVD single crystal diamond material according to claim 30, wherein the mark of origin or fingerprint is in the form of a single group or pattern comprising one or more marking layers, each layer having a thickness within the range of 10  $\mu\text{m}$  to 1000  $\mu\text{m}$ .

Claim 45 (Original): CVD single crystal diamond material according to claim 44, wherein each layer has a thickness within the range of 20  $\mu\text{m}$  to 600  $\mu\text{m}$ .

Claim 46 (Original): CVD single crystal diamond material according to claim 45, wherein each layer has a thickness within the range of 50  $\mu\text{m}$  to 400  $\mu\text{m}$ .

Claim 47 (Original): CVD single crystal diamond material according to claim 46, wherein each layer has a thickness within the range of 100  $\mu\text{m}$  to 250  $\mu\text{m}$ .

Claim 48 (Previously Presented): CVD single crystal diamond material according to claim 30, wherein the mark of origin or fingerprint is in the form of a multiple or repeating pattern each comprising one or more marking layers, each layer having a thickness within the range 2  $\mu\text{m}$  to 100  $\mu\text{m}$ .

Claim 49 (Original): CVD single crystal diamond material according to claim 48, wherein each layer has a thickness within the range 5  $\mu\text{m}$  to 50  $\mu\text{m}$ .

Claim 50 (Previously Presented): CVD single crystal diamond material according to claim 30, which, under suitable illumination conditions, exhibits orange luminescence arising from 575 nm/637 nm N related defect centres and, under or after the same or other suitable

illumination conditions, exhibits blue phosphorescence associated with donor acceptor pair recombination.

Claim 51 (Previously Presented): CVD single crystal diamond material according to claim 30, which, under suitable illumination conditions, exhibits more than one discrete layer in which the ratio of the thicknesses of the layers is in accordance with a pre-determined pattern.

Claim 52 (Original): CVD single crystal diamond material according to claim 30, wherein the fingerprint or mark of origin comprises one or more layers free of defects with distinguishing properties embedded in a larger volume of material, which is marked by defects with distinguishing properties.

Claim 53 (Currently Amended): CVD single crystal diamond material according to claim 30, wherein the fingerprint or mark of origin is ~~used as or in the manner of~~ capable of acting as a trademark.

Claim 54 (Withdrawn): An apparatus for detecting a mark of origin or fingerprint in a CVD single crystal diamond material bearing the mark of origin or fingerprint, the apparatus comprising:

a body arranged to receive or hold CVD single crystal diamond material bearing the mark of origin or fingerprint;

a source of light or radiation arranged to direct the light or radiation at the CVD single crystal diamond material, the light or radiation being of a wavelength suitable for causing excitation of the mark of origin or fingerprint resulting in luminescence and/or

phosphorescence thereof to expose the mark of origin or fingerprint; and a detection means for detecting the exposed mark of origin or fingerprint.

Claim 55 (Withdrawn): An apparatus according to claim 54, wherein the detection means comprises a viewer for viewing the luminescence and/or phosphorescence, or an instrument providing a measure of the intensity of the specific luminescence and/or phosphorescence.

Claim 56 (Withdrawn): An apparatus according to claim 55, wherein the measure of the intensity of the specific luminescence and/or phosphorescence is in the form of an analog or digital electrical signal, or display readout.

Claim 57 (Withdrawn): An apparatus according to claim 54, wherein the apparatus comprises a range of optical filters for viewing the wavelengths emitted by the mark of origin or fingerprint, and means for excluding background white light or wavelengths present which may be detrimental to observing the wavelengths emitted by the mark.

Claim 58 (Withdrawn): An apparatus according to claim 54, further comprising magnification means for magnifying the exposed mark of origin or fingerprint in the CVD single crystal diamond material.

Claim 59 (Withdrawn): An apparatus according to claim 54, wherein the apparatus is arranged preferentially to excite 575 nm and/or 637 nm luminescence.

Claim 60 (Withdrawn): An apparatus according to claim 54, wherein the apparatus is arranged preferentially to excite blue band phosphorescence peaking in the region of 400-500 nm.

Claim 61 (Withdrawn): An apparatus according to claim 54, wherein the apparatus is arranged preferentially to excite 575 nm and/or 637 nm luminescence and thereafter preferentially to excite blue band phosphorescence peaking in the region of 400-500 nm.

Claim 62 (Withdrawn): An apparatus according to claim 54, wherein the apparatus is arranged preferentially to excite the 737 nm luminescence peak.

Claim 63 (Withdrawn): An apparatus according to claim 59, further comprising one or more optical filters for enhancing detection of the 575 and/or 637 nm luminescence.

Claim 64 (Withdrawn): An apparatus according to claim 63, comprising an optical filter arranged to block the transmission of wavelengths near 450 nm, thereby to enhance viewing or detection of the 575/637 nm luminescence.

Claim 65 (Withdrawn): An apparatus according to claim 60, further comprising one or more optical filters for enhancing detection of the blue band phosphorescence peaking in the range 400-500 nm.

Claim 66 (Withdrawn): An apparatus according to claim 59, wherein the source of light or radiation is selected to provide illumination in the 300-550 nm range.

Claim 67 (Withdrawn): An apparatus according to claim 66, wherein the source of light or radiation is a high power light emitting diode.

Claim 68 (Withdrawn): An apparatus according to claim 60, wherein the source of light or radiation is selected to provide illumination in the 225-275 nm range.

Claim 69 (Withdrawn): An apparatus according to claim 68, wherein the source of light or radiation is a pulsed Xenon source.

Claim 70 (Withdrawn): An apparatus according to claim 68, wherein the source of light further comprises a filter to exclude wavelengths outside the range 225-275 nm.

Claim 71 (Withdrawn): An apparatus according to claim 68, wherein an observer or detector is protected from UV radiation from the source of light or radiation by the use of a window, such as a glass or Perspex window, which absorbs UV in the range 225-275 nm.

Claim 72 (Withdrawn): An apparatus according to claim 62, wherein the source of light or radiation is selected to provide illumination in the range 480-700 nm.

Claim 73 (Withdrawn): An apparatus according to claim 72, wherein the source of light or radiation is a 633 HeNe laser.

Claim 74 (Withdrawn): A method of viewing or detecting a mark of origin or fingerprint in a CVD single crystal diamond material bearing the mark of origin or

fingerprint, which mark of origin or fingerprint is not visible under normal viewing conditions, the method including the steps of:

- a) directing a source of light or radiation at the CVD single crystal diamond material, the light or radiation being of a wavelength suitable for causing excitation of the mark of origin or fingerprint resulting in luminescence and/or phosphorescence thereof to expose the mark of origin or fingerprint; and
- b) viewing or detecting the exposed mark of origin or fingerprint.

Claim 75 (New): CVD single crystal diamond material according to claim 30 in which the mark of origin or fingerprint is provided in the form of one or more layers or regions of the diamond material.

Claim 76 (New): CVD single crystal diamond material according to claim 30 in which the mark of origin or fingerprint is present in two or more layers.

Claim 77 (New): CVD single crystal diamond material according to claim 30 in which the mark of origin or fingerprint is present in two layers separated by a spacer layer.

Claim 78 (New): CVD single crystal diamond material according to claim 30 in which the mark of origin or fingerprint is present in three layers separated by spacer layers.

Claim 79 (New): A method according to claim 1, which additionally comprises detecting the mark of origin or fingerprint by visual detection or using optical instrumentation when exposed to illuminating light of a wavelength that has insufficient energy to excite

Application No. 10/582,707

Reply to Final Office Action of October 2, 2009

electrons right across the band gap in diamond, that is capable of exciting the defect centres and is shorter than the characteristic wavelength of the emitted radiation.